OUR ASTRONOMICAL COLUMN.

Observation of Encke's Comet on December 25, 1907.—From No. 4226 of the *Astronomische Nachrichten* (p. 31, January 7) we learn that, having found Encke's comet on January 2, Prof. Wolf examined some earlier plates, and found an image of the comet on one taken at 7h. 20m. December 25, 1907 (Königstuhl M.T.). Its position at that time was R.A. = 22h. 57·4m., $\delta = +0^\circ\ 54'$, and its magnitude 13·0. Owing to its being near the edge of the plate, this image was overlooked at first. From this observation it appears that the recently published ephemeris (*Astronomische Nachrichten*, No. 4222) requires corrections of +2·4m. and $-24'$.

A newly discovered Bright Minor Planet (1908 B.M.).—A comparatively bright planet was discovered by Dr. Kopff at Heidelberg on January 4. Its position at 12h. 27·6m. (Königstuhl M.T.) was $\alpha = 7$h. 33m. 48s., $\delta = +14^\circ\ 57'$, and its daily motion −1·4m. and $-20'$. The magnitude of this object was recorded as 9·2. Dr. Przybyllok observed the planet with the 12-inch refractor of the Astronomischen Institut on January 5, and found it to be equal in magnitude to B.D. + 14°.1717 (magnitude, 9·4) (*Astronomische Nachrichten*, No. 4226, p. 31, January 7).

Measures of Double Stars.—In No. 4227 of the *Astronomische Nachrichten* (p. 33, January 8), Messrs. C. P. Olivier and R. E. Wilson publish the results of 420 observations of 116 double stars made at the Leander McCormick Observatory, University of Virginia, during the years 1904–7. Seven of the doubles in this list were discovered by Mr. Olivier, and are now published for the first time. Notes as to the probable motions of some of these doubles are appended to the paper.

Ephemeris for Comet 1907*e*.—A bi-daily ephemeris for comet 1907*e*, covering the period January 13 to February 22, is published in No. 4226 of the *Astronomische Nachrichten* by Herr M. Ebell. An observation by Dr. Wirtz, made at Strassburg on December 4, gave the magnitude as 12·7.

The Absorption of D_3 (Helium) in the Neighbourhood of Sun-spots.—In an article appearing in the *Observatory* (p. 51, No. 392, January), Father Cortie discusses some photographs of sun-spot spectra obtained by Mr. Nagaraja at the Kodaikánal Observatory last year. The special point of these photographs was that, with a spot near the limb of the sun, they are supposed to show the bright line at the limb and the dark absorption line in the region of the spot at the same time. Father Cortie's discussion tends to show that the dark line in question is, possibly, not coincident with D_3, and is perhaps the water-vapour absorption line at λ 5875·963. He has many times recorded lines attributed to water-vapour in the spectra of sun-spots, and suggests the possibility of the presence of superheated steam in sun-spots.

In regard to the recent suggestions that a permanent dark D_3 line occurs in the solar spectrum, Father Cortie points out that Mr. Higgs and he thoroughly investigated the question seventeen years ago, and concluded that there was no permanent dark line coincident with the bright D_3; since then no conclusive evidence has been adduced to lead him to alter that conclusion.

The Orbit of the Spectroscopic Binary θ Aquilæ.—No. 6, vol. i., of the Journal of the Royal Astronomical Society of Canada (p. 357, November–December, 1907) contains a preliminary set of elements for the orbit of the spectroscopic binary θ Aquilæ. This star has a photographic magnitude of 3·6, and its spectrum is of the type VII*a*. Mr. W. E. Harper, of the Dominion Observatory, Ottawa, who publishes the elements, finds that Deslandres's conjecture of a 16·8-day period and a high eccentricity is confirmed. The present elements give 17·17 days as the period, −26·7 km. per sec. as the velocity, 0·725 as the eccentricity, and 8,455,500 km. as the length of the semi-major axis of the orbit.

Eclipse Observations, August, 1905.—No. 15 of the *Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg* contains M. Donitch's report of the results obtained by the expeditions dispatched by the academy to observe the eclipse of 1905. Two expeditions were organised, one going to Alcala de Chisvert (Spain), the other to Assouan. The object of the former was to study the chromosphere and corona, whilst the attention of the latter was chiefly devoted to observations of terrestrial magnetism. In the present paper M. Donitch, who directed the expedition to Spain, discusses the purely astronomical results. Photographs of the chromospheric spectrum were obtained, and the wave-lengths and origins of some 110 lines are given in tabular form. In addition to those of H, He, Ca, Sc, Ti, Cr, Fe, Sr, Yt, and Ba, there are indications of the presence of lines of Co, Zr, Eu, and, possibly, Ge in the spectrum. The depths of the layers of these various elements in the chromosphere were measured, those of hydrogen and calcium giving the highest numbers, 49,300 kilometres and 44,000 kilometres respectively. The dimensions of five prominences as shown in radiations of various wave-lengths are also given.

The photographs of the corona show it to have been of the "maximum" type, as one would expect in 1905. Reproductions from several of the photographs obtained accompany the paper.

We have also received a finely illustrated volume containing a full discussion of the results obtained by the astronomical section of the Observatory of Cartuja, Granada, Spain. In this work, published under the direction of P. José Mier y Terán, S.J., most of the questions and theories arising from eclipse observations are discussed at length, so that the volume, which is printed in Spanish, forms a useful reference work for future observers.

SCIENCE AT RECENT EDUCATIONAL CONFERENCES.

There is no ebb in the tide of educational congresses. On the contrary, the number of teachers' organisations increases year by year, the number holding annual meetings during the last month in London alone running well into double figures. Nor is there any falling off in the vigour of the individual associations; indeed, in the case of the London County Council Conference, large numbers were unable to gain admission owing to the crowded state of the hall. This particular conference brought together more than twelve hundred workers in education, the majority of whom were teachers in L.C.C. elementary and secondary schools and technical institutes. We propose to review this meeting and that of the Public Schools Science Masters' Association, but desire to preface a few remarks on the effect of the multiplication of societies for the furtherance of various branches of education.

The time has gone by when a schoolmaster was expected to be able to teach all the subjects of the curriculum. Improved methods of teaching have in every subject called for a greater mastery on the part of the teacher, so that just at present we appear to be saved from having a specialist for every subject in the curriculum solely by considerations of financial economy. The science master teaches nothing but science, and is apt to lose interest in, and to be out of touch with, other subjects, and, *mutatis mutandis*, this is true of the modern language master and of the others. Hence we find segregation of teachers into their respective associations, each dealing with its particular branch of study. The advantages of these independent meetings are not far to seek. If the discussion refers to the teaching of physics, for example, the whole audience may be assumed to have some expert knowledge and to be intimately concerned in arriving at a right judgment. The informal and social side of the meetings, not their least valuable function, may be easier to promote, because each feels that he can exchange views with his neighbour to their mutual profit. But there are drawbacks to this segregation. Nothing was more frequently insisted on during the debates of the Public Schools' Science Masters than the need for cooperation between the teachers of mathematics and physics. One speaker urged that nominees of the Public Schools' Science Masters' Association should confer with nominees of the Mathematical Association to promote this end. In our opinion, this proposal falls very short of what is required. It would be better to hold a joint general meeting of the two associations, which would be better calculated to lead to an appreciation on the part of individual members in each body of the aims and difficulties of their colleagues in the allied camp. It would be easy to suggest other joint meetings of associations which would be helpful just now. Sections of the British Association unite to discuss problems on their boundaries, and this with better effect than by joint committees. Moreover, the various sections of the British Association belong to one body, and the general public recognises the importance of conclusions carrying its imprimatur. Would not teachers have more public influence if the existing associations were federated? The specialising influence to which we have referred should not be allowed to become a narrowing influence, and to that end teachers should from time to time hear addresses from first-rate men on subjects outside their own branch. The influence of science is probably weakened at the present time by the confinement of all scientific subjects to a technical society or body of experts. Science was practically omitted from the agenda of all the educational conferences this winter, except of the two which we will now describe.

LONDON COUNTY COUNCIL CONFERENCE.

The subjects dealt with fall under the four heads nature-study, commercial education, manual work, and pædogogic experiments, and we will omit all further reference to the second of these.

"The Place of Nature-study in the School Curriculum" was the title of the opening paper by Dr. Percy T. Nunn, and it would be difficult to imagine a better introduction than the philosophical exposition given by the vice-principal of the London Day Training College. The basis of Dr. Nunn's arguments was the principle that it is the business of the educator to cultivate groups of interests rather than to teach useful subjects. While recognising that nature-study could well contribute to the æsthetic side of the curriculum, it had clearly to be recognised on the whole as an integral part of the instruction in science. The science curriculum should be so thought out as to secure continuity of development in conformity with the characters which distinguished the successive levels of the scientific process. Of these levels or stages, the highest and latest was the stage of system pursued for its own sake, a stage scarcely reached at school by ordinary pupils. Before this was the utilitarian stage, in which the greater part of elementary science teaching should fall. The foundation should be the nature-study stage, in which "science is born of wonder." These stages were not separable by clear lines of demarcation, and it was a mistake to allow their continuity to be interrupted, as when topics introduced in the nature-study lessons were afterwards allowed to drop. In the case of rainfall, for instance, the first simple studies should lead through the investigation of dew-point to hygrometry, the measurement of vapour-pressure, and thence to the doctrine of the continuity between liquids and gases. Dr. Nunn stated, in conclusion, that science of the higher type could not be a completely healthy growth unless it sprang out of the foundation of nature-study. The papers which followed, on school excursions, and the use of the school museum, dealt with practical points in the management of these aids to teaching. Both authors and subsequent speakers emphasised the importance of observations being made under conditions as little artificial as possible. The superiority of open-air work was generally admitted, but, in addition to difficulties with regard to time and place, some speakers found obstacles in the regulations under which they worked.

The afternoon discussion was practically confined to the subject of botany teaching in girls' schools, Miss Lulham discussing the approach to the subject through nature-study, Miss Lilian Clarke describing the botanical laboratory and school gardens at Dulwich, and Miss von Wyss tackling the difficult problem of teaching large classes in elementary schools. Space does not permit us to enter into detail, so we must content ourselves with stating that each of these papers bristled with practical suggestions based on actual experience, and suited to ordinary conditions of work, where the pupils are many and the time circumscribed. We may remind our readers that a verbatim report of the conference will be issued by the County Council, and advise teachers working with strictly limited funds and a lack of cupboards and other fittings to study the very helpful recommendations made by Miss von Wyss. It is not surprising that, stimulated by her teaching, a natural history club could be started and be continued as an evening class after leaving school in a district which at first sight appeared unpromising. In passing, we may note that Miss Lulham pointed out the virtues of colt's-foot as a plant for all-the-year-round study by beginners, so we may bless as teachers the persistent weed which as gardeners we are disposed to ban. In the discussion the papers met with hearty approval, an inspector of secondary schools pointing out that many important girls' schools had given up botany after trying to teach the subject on wrong lines. There was general agreement that the study of botany became highly interesting and educative if the following conditions were fulfilled:—(1) the living plant must be studied; (2) the pupils must keep plants under observation for lengthened periods, making notes and diaries illustrated by their own sketches direct from nature; (3) the pupils must experiment; (4) the teacher must prepare the lessons very carefully, and then leave as much as possible to be done by the pupils themselves. The moral and æsthetic influences of the study of nature were not forgotten, and it was rightly pointed out that the teacher must not forget that plants are living and beautiful. Is it too much to hope that a love of nature may attract youngsters to healthier interests than those stimulated by the poor silly trash which is so much read?

Sir John Cockburn presided at the discussion on manual training, and pointed out its importance from the physiological standpoint. Motor instruction conformed to natural methods, and the moment these methods were departed from the work of the teacher became a distortion of what it should be. The brain could only be built up properly through the action of the muscles. Dr. Slaughter, late assistant to Dr. Stanley Hall, read a paper on the need of manual training in the lower standards, in which he insisted on the idea of training all classes for citizenship. Scientific investigation showed that the human body was no longer to be regarded as separate from the human mind, and that thought was truncated action. He based his hopes for the future of education on manual training, although present methods were open to serious criticism. Perhaps their greatest fault was that they aimed too much at the acquisition of technique, whereas such training should be in daily use for its adaptive educational value. It should mean more than hand training, should make use of drawing, and should give knowledge about geography, animals, and plants. Mr. J. C. Hudson gave an account of manual work in American elementary schools, some making it merely supplementary, whilst others use it as a means of correlating all subjects. Perhaps the underlying idea may be indicated by the substitution of the terms "expression work" and "associative activities" for the term "manual training." Mr. P. B. Ballard considered the position of manual work in Standards I. to IV. of the senior departments of English elementary schools. As the result of a recent inquiry, he obtained replies from 120 educational authorities, which showed that only sixteen authorities adopted a systematic course of hand-work. As regards London, courses in brush-work, clay-modelling, &c., were rare, except in the special schools for the mentally and physically defective, so that in the matter of motor training the lost sheep was looked after and the ninety and nine forgotten. Mr. Ballard proceeded to advocate the application of hand-work to ordinary school subjects, and gave a series of illustrations of his ideas as applied to arithmetic, geography, and history. He wished to bridge the gap at present existing between the kindergarten occupations of the infants' department and the manual and domestic work of the senior standards.

During the sitting devoted to educational experiments in elementary schools, a paper was read by Mr. H. J. Hazlitt, in which the author described in detail how he had been conducting classes in open-air geography. By making previous provision of home-made survey maps and notes, the class was able to take an enlightened interest in an excursion to Crowhurst. Open-air work gives a genuine foundation to the study of geography, and thereby that essential factor, the map, can be properly understood.

PUBLIC SCHOOLS' SCIENCE MASTERS' ASSOCIATION.

The salient features of the annual meeting, held at Westminster School on January 14, were :—(1) the address from Prof. H. A. Miers, F.R.S. ; (2) the instructive exhibition of apparatus ; (3) the discussion on the position of mechanics in the physics course ; (4) the repeated expression of the need for cooperation between the masters responsible for mathematics and physics respectively.

Prof. Miers took as his subject the order in which scientific ideas should be presented. He deprecated any rigid division of science into subjects, and believed that harm had resulted from attempts to keep mathematics, physics, and chemistry apart from each other, and to confine them to separate teachers. He desired to leave freedom to the individual teacher as regards method, but felt that as regards order there should be more system in our science teaching. In other subjects there was an advantage in having a recognised order based upon prolonged experience, and science should stand upon the same level as languages and mathematics in our schools, and should form an integral part of any liberal education. It was not easy to find out at the moment what the pupil understood of the instruction, and where he had succeeded in analysing the difficulty of a pupil he generally discovered that he himself was at fault in having presented ideas in the wrong order, and assumed something which was not yet familiar to the pupil. He found a useful guide to the proper order in the succession in which the ideas of a science had been developed in its past history.

Prof. Miers advocated nature-study in the wide sense ; the boy should be taught to notice the ordinary objects and events of his own world, and to draw scientific nourishment therefrom, including in his intelligent observation all that was going on around, and not merely the processes of nature familiar in country life. If only the ordinary boy could get into his head the notion that science was the intelligent study of ordinary things, he would cease to regard it as a mere educational task. It was unwise, if not impossible, to teach chemistry and physics as independent subjects. In the preparatory school the boy should be trained in observational work, which would impart information useful in the experimental science that was to come next. The systematic teaching at a public school should from the outset be experimental, and the spirit of inquiry should be cultivated, and scientific dogmatism guarded against.

Coming to the university teaching of science, we had now to deal with mature minds, and the spirit of research should absolutely dominate the teaching. There was nothing better for encouraging research than natural history, which was admirably suited for advanced study at the university. Original papers were more stimulating than text-books, and there is need for an English series reproducing the original researches of highest importance, perhaps with the translation of archaic expressions into modern equivalents. Lectures should follow the historical order, laboratory work the method of research.

Prof. Armstrong felt it to be a deplorable fact that science had lost ground in public estimation. We felt the absence of Huxley and Playfair, and it rested with the public schools to carry the banner forward. The Davy-Faraday laboratory had, with one exception, failed to attract the gilded youth, fired with enthusiasm for science by their work in public schools. We must teach so as to excite more interest, so as to make that interest more continuous and permanent, and so as to cultivate, not powers of observation only, but the faculty of keen, intelligent criticism also. He held that Germany had achieved her position owing to the cultivation of originality by her universities.

The other papers read during the meeting were :—(1) the educational value of mechanics, by Mr. C. F. Mott (Giggleswick) ; (2) the teaching of practical mathematics, by Mr. H. Wilkinson (Durham) ; (3) scheme for laboratory work in physics, by Mr. Cumming (Rugby) ; (4) a suitable physics curriculum for the first and second years, by Mr. W. E. Cross (Whitgift) ; (5) the compulsory teaching of elementary physics to junior forms, by Mr. J. M. Wadmore (Aldenham).

In the course of the discussions, it was pointed out that there is a great leakage from schools of boys who are under the proper leaving age, and that such boys necessarily receive little scientific education. There was no lack of enthusiasm for science on the part of boys who fulfilled the course of instruction. The fact that boys were promoted in many schools without regard to their science work placed difficulties in the way, such as were met by re-arranging the schools in sets in the case of mathematics. The study of scientific mechanics might be postponed until boys had obtained some experience in general experimental physics ; practical work in heat could be introduced earlier. Boys should be allowed to use modern electrical plant, such as the cheaper voltmeters and ammeters now available through being put on the market for motorists. Mr. Cross advocated the abandonment of the usual exercises in mensuration and Archimedes's principle, and the substitution of a course of experimental construction of working cranes, &c. He would devote the first two years to such work, which stimulates interest and leads to a grasp of principles, *e.g.* the inquiry into the transmission of power by belts leads to true notions about energy and friction. It is a pity that there was little criticism of this interesting and unorthodox paper, for there is no doubt that most boys want to know "how it works" ; moreover, the course which Mr. Cross outlined can readily fulfil Prof. Miers's requirement that the application of the instruction to everyday life should be straightforward. The relative merits of working collectively or individually in the laboratory were discussed, and Mr. Cumming claimed that the former system proved successful at Rugby. In summing up the discussion, Prof. Miers remarked upon the extreme diversity of methods adopted in different schools.

The exhibition of apparatus attracted well-deserved attention. Several dealers in apparatus, and some of the leading publishers, sent extensive exhibits, but the most gratifying, and in many respects the most instructive part of the exhibition was the ingenuity of the home-made contrivances sent from a good number of schools. We must congratulate and thank those responsible, and particularly Mr. D. J. P. Berridge, to whose organisation much of the success of this feature of the meeting was due. There were so many items of interest that it is impossible to describe them all, and it seems invidious to select. On the score of daring simplicity, we may perhaps award the palm to a motor armature shown by Mr. C. J. L. Wagstaff, which consisted of a bottle-cork, a few turns of insulated wire, and a dozen pins. Dr. T. J. Baker reached the acme of simplicity in his supports for prisms, lenses, &c. These were mounted by being stuck in their appropriate positions into lumps of plasticine—*voilà tout*! We would suggest to the management the advisability of printing a large number of copies of the catalogue ; they might be put on sale ; in any case their wider diffusion would help to improve experimental teaching by simple apparatus of homely invention and make.

G. F. DANIELL.

THE INTERDEPENDENCE OF MEDICINE AND OTHER SCIENCES.[1]

AN historical sketch, necessarily brief and inadequate, of some of the principal phases in the reciprocal relations between medicine and the physical sciences, up to the time when the latter became fully independent at the close of the seventeenth century, will show with what propriety medicine has been called the "mother of the sciences."

Physical science has derived from the Greeks no such extensive records of sound observation and experience as those which medicine has inherited from the writings of Hippocrates and his followers. Physical theories embodied in the speculations of the nature-philosophers concerning the constitution and properties of matter furnished the

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[1] From an address delivered by Dr. W. H. Welch, professor of pathology, Johns Hopkins University, Baltimore, as the retiring president of the American Association for the Advancement of Science, at Chicago, December 30, 1907.